UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

JoAnn Truchan, MPM, PE
Allegheny County Health Department
Air Quality Program
301 39th Street, Building #7
Pittsburgh, PA 15201

Dear Ms. Truchan,

The Environmental Protection Agency (EPA) offers the following comments on the proposed Prevention of Significant Deterioration (PSD) and Non-Attainment New Source Review (NSR) Permit for Allegheny Energy Center LLC – Invenergy LLC. This permit will authorize the construction and operation of a 639 megawatt natural gas-fired combined cycle power plant. The facility triggers NSR requirements for NO_x and VOC (as ozone and PM 2.5 precursors) and PSD requirements for NO_x, CO, PM, PM_{10}, sulfuric acid mist (H_2SO_4), and greenhouse gases (CO_2e)

These comments are provided to ensure that the project meets federal Clean Air Act requirements, that the permit will provide necessary information so that the basis for the permit decisions is transparent and readily accessible to the public, and that the permit record provides adequate support for the decisions. Comments have been included that would apply for a title V permit as well.

I. <u>PERMIT/ENGINEERING ANALYSIS COMMENTS:</u>

Combustion Turbine (CT01) Startup Shutdown: BACT and LAER limits must be established during all modes of operation, including startup and shutdown.

1. Condition V.A.1.n and V.A.1.p exempt various emissions limits during period of startup and shutdown of CT01. However, page 3-2 of the application indicates that while NO_X, VOC, and CO emissions vary during startup and shutdown, other NSR pollutant emissions do not. Please remove the exemptions for these other pollutants and establish limitations for NO_X, VOC, and CO during periods of startup and shutdown.

2. Note that lb/event BACT and LAER limits for CT01 cold start, warm start, hot start, and shutdown events were proposed for NO_x (5-24), CO (5-30), and VOC (5-38) in the facility application. However, these requirements do not appear in the permit as limits. Please establish BACT and LAER limits for startup and shutdown events and include those in the permit. Please ensure the analysis in determining these limits includes comparison to emissions limits achieved by similar operations[1].
3. To calculate potential emissions and establish emissions limits for CT01, 365 startup and shutdown events were assumed. For these limits to be practically enforceable there must be associated operational or production limits such as the number of startup and shutdown events included as permit conditions.[2] Note on Page 3-4 of the application, the facility requested the following limit: "Total startup and shutdown events not to exceed 365 events per rolling 12-month period". However, this requirement does not appear in the permit. Please establish in the permit operational limits on the number of startup and shutdown events and any other parameters assumed in establishing emissions limits such as event duration.

B. BACT and LAER determinations

4. BACT and LAER are emissions limits established by a permit authority. Appendix B to the review memo indicates controls the facility proposed in order to meet BACT and LAER limits; however, it is not clear what ACHD has determined as the BACT and LAER emissions limits. We suggest clarifying ACHD's determinations in the review memo.

C. 40 CFR Part 60, Subpart KKKK

5. Pursuant to 40 CR §60.4330(a)(1) and (2) and as indicated on page 4-9 of the facility application, CT01 is subject to SO_2 limits of 0.90 lb/MWh gross output and 0.060 lb/MMbtu heat input. However, condition V.A.1.g. of the permit only includes a 5.6 lb/hr and .0014 lb/MMBtu heat input limit. Please:
   a. Incorporate the 0.90 lb/MWh gross output limit and cite to both §60.4330(a)(1) and (2)
   b. Indicate in the review memo that the KKKK 0.060 lb/MMbtu limit is streamlined out by a more stringent limit, but still is an applicable requirement

D. Testing

6. Condition V.A.2.d. requires regular PM, PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO, NH_3, VOC, formaldehyde, and sulfuric acid mist emissions testing on the combustion turbine and HRSG stack as required by Article XXI §2108.02.b to demonstrate compliance with conditions V.A.1.e through V.A.1.n.
   a. Please specify the testing frequency required in the permit condition
   b. This condition does not require testing to demonstrate compliance with the lb/hr emissions limits in Table V-A-1. Please incorporate regular testing requirements for these emissions limits as well.

7. Condition IV.14.a. establishes a site-wide requirement to perform initial emissions testing specified by the Department pursuant to Article XXI §2108.02. Please include in the permit the initial emissions testing that the Department will require

E. Assuring Compliance with CT VOC limits

8. It is unclear how compliance with CT01 VOC limits is assured. Both CO and NOx have continuous emissions monitoring devices, however there is no monitoring device for VOC. On page 5-37 of the application, the facility suggests a correlation factor between CO and VOC emissions during an initial performance test by simultaneously operating CO CEMS while stack testing following U.S. EPA Reference Method 18, 25A. However, no monitoring recordkeeping or reporting requirements exist in the permit to establish this correlation. Please incorporate.

II. AIR QUALITY ANALYSIS REPORT

A. EPA comments on the modeling analysis are included in Enclosure 1.

Thank you for the opportunity to review this proposed permit. If you have any questions or concerns regarding these comments, please contact me or Riley Burger of my staff at 215-814-2217.

Sincerely,

MARY CATHERINE OPILA

Digitally signed by MARY CATHERINE OPILA
Date: 2021.06.07 14:41:27 -04'00'

Mary Cate Opila, P.E., Ph.D.
Chief, Permits Branch
Air & Radiation Division
EPA Region 3

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[1] See October 1990 New Source Review Workshop Manual for further guidance on establishing BACT and LAER

[2] See June 13, 1989 John S. Seitz Memo: Guidance on Limiting Potential to Emit in New Source Permitting

EPA Comment 01, Pennsylvania Ambient Air Quality Standards: The modeling analysis does not appear to address the Commonwealth's ambient air standards outlined in 25 PA code § 131.3[1]. Pennsylvania has established ambient-air standards for settled particulate, beryllium, fluorides, and hydrogen sulfide.

An analysis of Invenergy Allegheny Energy Center's (AEC) emissions for these pollutants may be sufficient to address these additional ambient-air standards. If AEC is a very minor source for these pollutants, providing an estimate of these emissions may be sufficient to address the Commonwealth's additional ambient air quality standards.

EPA Comment 02: The Allegheny County Health Department (ACHD) should provide a more complete description[2] of its AERMET preprocessing steps or direct reviewers to a more detailed description of the AERMET processing steps included in the documentation shared with EPA Region 3. An archive of electronic files used to develop the final model ready AERMOD meteorological files should be included in the final documentation. It would also be helpful if ACHD shared its QA/QC procedures to verify the wind measurements made at the Liberty monitor. This will ensure the wind fields were collected in accordance with EPA's on-site meteorological data collection recommendations[3].

Meteorological Processing Documentation: A detailed description of the meteorological data used in the dispersion modeling address would be useful. This could include the raw input files and the processing steps used to develop the final AERMOD ready meteorological input files included in the analysis. A search of the documentation the ACHD shared with EPA Region 3 did not appear to include any files associated with the EPA AERMET preprocessor program.

The Invenergy Allegheny Energy Center (AEC) modeling appeared to utilize meteorological data that included hourly surface wind measurements from the Allegheny County Health Department's (ACHD) Liberty monitoring site (EPA ID 42-003-0064). Final processed meteorological files (.sfc and .pfl) were included in the shared documentation. They appear to be 5 years (of representative) Liberty hourly surface observations coupled with upper air soundings from Pittsburgh International Airport from 2010 through 2014. The .sfc file header identifies that a cloud cover substitution was utilized (CCVR_Sub) to generate the surface AERMET input file (using the Pittsburgh International ASOS site, cloud cover only option). This is probably because the Liberty monitoring site does not include cloud cover data necessary to generate the

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[1] See: http://www.pacodeandbulletin.gov/Display/pacode?titleNumber=025&file=/secure/pacode/data/025/025toc.html

[2] EPA notes there is a brief description of the meteorological processing steps in the "modeling.zip" file included in the electronic file archive: directory "modeling/invenergy c2015-10-29modeling/Buena Vista Modeling/Buena Vista Modeling/ LIBPIT_2010-2014.zip"

[3] See ***Meteorological Monitoring Guidance for Regulatory Modeling Applications***, EPA-454/R-99-005, February 2000: https://www.epa.gov/sites/production/files/2020-10/documents/mmgrma_0.pdf

final AERMET processed meteorological input file. The .sfc file also indicates that the final AERMET files used in the analysis were generated using AEMET version 15181 (without the adjusted u* option available in the more current versions of AERMET).

EPA utilized R's openair[4] package to process the AERMOD ready meteorological files included in the modeling analysis and generate wind roses for the 5-year data set. R[5] is an open source language and environment for statistical computing and graphics.

Several sets of wind roses were produced using R and are included as additional information regarding the meteorological data utilized in the modeling analysis. Figure 1 shows the 5-year wind rose using the Liberty monitor wind measurements. Each radial on the wind rose represents a percentage of hours with winds originating from that direction. Radials are color coded based on wind speed. AERMET wind speeds are assumed to be in metric units of meters per second (m/s). It is not known what units the Liberty monitor collects wind speed values (scalar or vector) but they should have been corrected if they were measured in British imperial units such as miles per hour.

Liberty's predominant wind direction over the 5-year collection period was from the southwest. Figure 2 shows wind roses broken down according to season and daytime/nighttime periods. Seasonal patterns are slightly different but generally show predominant winds from the southwest sector. Wind speeds appear to be lower in the summer and fall seasons compared to the winter and spring seasons. This is in response to much stronger pressure gradients in the winter and spring due to larger temperature gradients generally experienced during these seasons. Wind distributions are similar between daytime and nighttime hours but wind speeds are generally lower during the overnight hours than during the day. Average daytime wind speeds are about 12.5% higher during the day and on average about 13% lower during the overnight hours compared to overall averages. Calm conditions (wind speeds under 0.5 m/s) are over 3 times more common during the overnight hours than during the day. There also appears to be more light winds from the northeast quadrant during the overnight hours. Light wind speeds generally correlate with higher dispersion model concentrations.

[4] Carslaw DC, Ropkins K (2012). "openair — An R package for air quality data analysis." Environmental Modelling & Software, 27–28(0), 52–61. ISSN 1364-8152, doi: 10.1016/j.envsoft.2011.09.008.
[5] R Core Team (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

Figure 1. Liberty Monitor Wind Rose

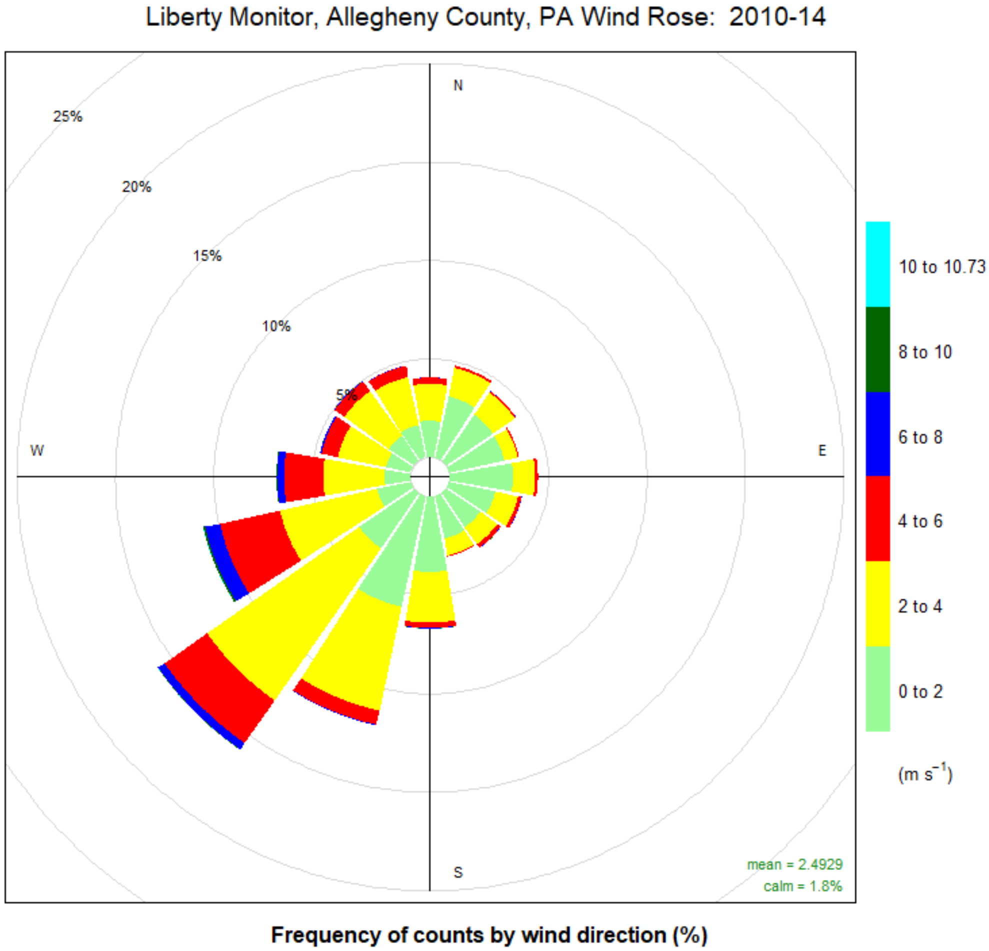
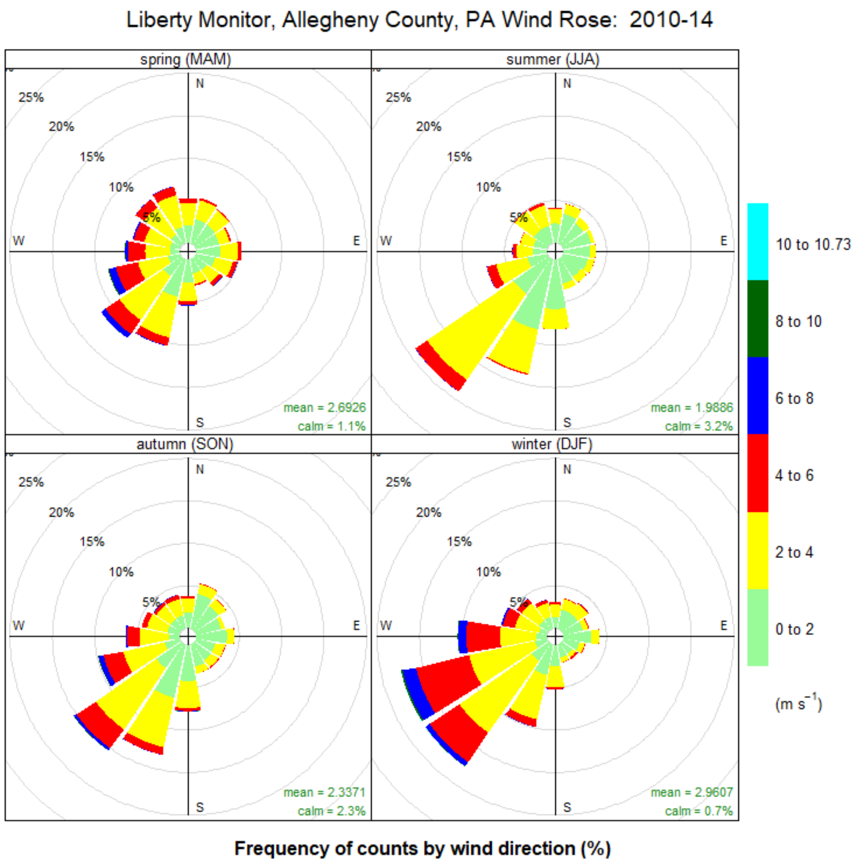
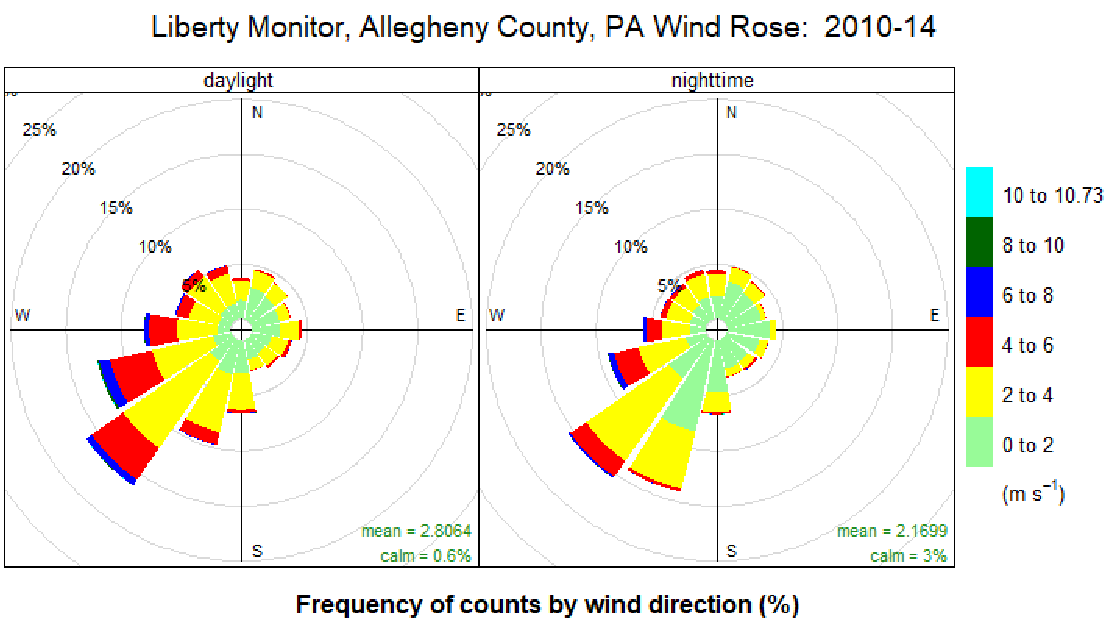


Figure 2. Liberty Wind Fields by Season and Daytime/Nighttime Categories





EPA Comment 03: Table 1 shows the hourly PM emission rates for the Invenergy AEC sources. The (hourly) emission rate for the PM-10 Class II 24-hr run does not match the auxiliary boiler emission rates for the other 5 other PM simulations; it is approximately 21% higher. PM emission rates for all the other Invenergy AEC sources are identical across the PM simulations. Please confirm if this is the proper emission rate for this source and if it is, why it is different than the other PM emission rates used for the auxiliary boiler in the other PM simulations.

Table 1. AERMOD PM Emission rates for Invenergy AEC (in g/s).

Invenergy Allegheny Energy Center AERMOD PM SIL Source Emissions (g/s)

AEC Source	PM-10 Class II 24-hr	PM-10 Class II Annual	PM-2.5 Class I 24-hr	PM-2.5 Class I Annual	PM-2.5 Class II 24-hr	PM-2.5 Class II Annual
Auxiliary Boiler	**0.016604361**	0.013730529	0.013730529	0.013730529	0.013730529	0.013730529
Combustion Turbine (Design Load)	2.599430774	2.599430774	2.599430774	2.599430774	2.599430774	2.599430774
Dewpoint Heater	0.000561591	0.000561591	0.000561591	0.000561591	0.000561591	0.000561591
Emergency Generator	0.003061017	0.003061017	0.003061017	0.003061017	0.003061017	0.003061017
Fire Pump	0.000284015	0.000284015	0.000284015	0.000284015	0.000284015	0.000284015
Combustion Turbine (Cold Start)	1.713571176	1.713571176	1.713571176	1.713571176	1.713571176	1.713571176

EPA Comment 04: It appears that some of the ancillary (intermittent) sources are contributing to the peak model concentrations in several of the SIL simulations. For CO, the emergency generator is accounting for the bulk of the modeled 1-hr (see Table 2) and 8-hr peak values. For the 1-hr NO_2 SIL simulations, the auxiliary boiler appears to be contributing to the maximum modeled concentrations (excluding the cold start emission scenario). For 24-hr (Class II) PM-10 and PM-2.5, the auxiliary boiler appears to account for a significant fraction of the maximum modeled concentrations.

These sources are intermittent in nature. They are not intended to run on a continuous basis like the main combined-cycle combustion turbine and therefore are probably unlikely to be operating under worst-case meteorological conditions. Given this information, it is likely that many of the model concentrations in the SIL simulations far exceed what would occur under normal operating conditions (operations with just the main combined-cycle combustion unit operating and possibly the dew point heater).

Significant Impact Level (SIL) Modeling Analyses: Invenergy AEC sources were run for each criteria pollutant then compared with the appropriate SILs to determine if cumulative modeling would be needed. Only the 1-hr NO_2 modeling run exceeded the SIL. ACHD provided an inventory of nearby sources (within Allegheny County) to include in the 1-hr NO_2 cumulative modeling analysis.

EPA reviewed the SIL AERMOD input files and confirmed all simulated stack parameters were consistent between the model runs. The Invenergy AEC auxiliary boiler emission rate for one of the particulate-matter (PM) simulations did not appear to match the other PM-10 and PM-2.5 SIL simulations (see EPA Comment 03).

Table 2 shows the impacts of each Invenergy AEC source on modeled 1-hr CO concentrations. Each source's maximum 1-hr CO concentration (as defined in AERMOD's source group category declaration) is shown in the table along with the date and time of the maximum model concentration. The Invenergy AEC Design Load and Cold Start groups include all AEC sources. These are grouped by the main combustion turbine (emissions) for normal operations (design load) and the worst-case operating load with the other AEC combustion sources. Other sources include the fire pump, emergency generator, dew point heater and auxiliary boiler. The later sources do not operate on a continuous basis and will most likely operate less than 500 hours per year.

As can be seen in Table 2, the emergency generator (assumed to be operating constantly in the SIL simulations) is the primary contributing source to the peak 1-hr CO model concentration. Model impacts from the emergency generator are approximately 2.5 times greater than the main combustion turbine. As noted previously, the emergency generator is an intermittent source and is not intended to operate on a consistent basis.

Table 2. Invenergy AEC Source Modeled 1-hr CO SIL Run Concentrations (μg/m^3)

Invenergy Allegheny Energy Center AERMOD 1-Hour CO SIL Run

Source Description	Source Max Concentration (ug/m3)	Date of Max	Hour of Max
Dew Point Heater	4.68059	2010-04-15	5
Auxiliary Boiler	101.96827	2011-04-23	15
Fire Pump	160.87262	2010-01-28	13
Emergency Generator	246.34176	2013-06-20	2
Cold Start (Turbine)	639.47565	2012-12-13	1
Invenergy AEC Design Load	639.55857	2012-12-13	1
Invenergy AEC Cold Start	639.55867	2012-12-13	1

1-hr NO_2 Cumulative Analysis: AERMOD concentrations based on NO_2 emissions from the Invenergy AEC exceeded the 1-hr NO_2 SIL. This necessitated a cumulative modeling analysis which included other off-site NO_2 emission sources in Allegheny County. The cumulative 1-hr NO_2 modeling analysis was used to assess Invenergy AEC's impact on local modeled 1-hr NO_2 concentrations within its original modeled significant impact area. Model impacts from Invenergy AEC were deemed significant if the average 5-year maximum 1-hr NO_2 concentrations[6] at any receptor exceeded 7.5 µg/m^3. ACHD summarized it's SIL modeling results in a table of its March 22nd review memo from Shaun Vozar[7].

Two NO_2 SIL scenarios were modeled. One using the design load, which included typical NO_2 emissions from the combustion turbine along with emissions from the dew point heater and the auxiliary boiler and another worst-case scenario where combustion turbine emissions were chosen to represent a cold start (without fully functioning NO_2 controls) with additional emissions from the auxiliary boiler and dew point heater. NO_2 emissions from the emergency generator and fire pump sources were omitted from the SIL analysis since they are intermittent sources[8]. ACHD's approach is typical for this type of analysis. Table 3 summarized the Invenergy AEC source emissions for the 1-hr NO_2 SIL simulations. Note the combustion turbine worst-case NO_2 emissions for the cold start simulation far exceed the emissions for more typical power-plant operations (design load).

Table 3. Invenergy AEC Modeled NO_2 Emission Rates for SIL Simulations

Invenergy Allegheny Energy Center AERMOD Stack Parameters 1-hr NO2 SIL

Source	Type	Emission Rate (g/s)	Stack Height (m)	Stack Temp (K)	Stack Velocity (m/s)	Stack Diameter (m)
Auxiliary Boiler	POINT	0.122936132	10.670	405.370	9.28000	1.200
Combustion Turbine (Cold Start)	POINT	31.82391468	54.864	344.261	17.73561	6.700
Combustion Turbine (Design Load)	POINT	4.084431295	54.864	341.817	22.85202	6.700
Dew Point Heater	POINT	0.00415793	7.620	622.040	6.35000	0.500
Emergency Generator	POINT	0.0	4.570	753.150	46.29000	0.500
Fire Pump	POINT	0.0	3.810	789.260	36.22000	0.200

EPA Comment 05: Modeled stack velocities for the emergency generator are approaching 50 m/s. Please confirm the stack velocity units used in the modeling analysis are in metric

[6] See March 1, 2011 clarification memo, *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard*
[7] See *Modeling Review of Invenergy LLC (Invenergy) Proposed Natural Gas Combined-Cycle Power Plant Installation Permit* memo, second table on page 12.
[8] As suggested in EPA's March 1, 2011 clarification memo, *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard*

(meters per second) and not British Imperial units (feet per second). All modeled stack parameters should be in metric units for consistency.

Both iterations of the 1-hr NO_2 simulations (combustion turbine cold start/design load) exceeded the 1-hr NO_2 SIL triggering a cumulative modeling analysis. Table 4 summarizes the modeling results for the SIL runs. While the final 1-hr NO_2 SIL results were relatively close in magnitude, the spatial distribution of model peaks indicates significant differences in the areal extent of model values exceeding the 1-hr NO_2 SIL.

The design load (typical operation of the combustion turbine) peak model concentration is located along the AEC's eastern ambient air (plant) boundary (see Figure 3). Given the peak modeled concentration information in Table 4, the model suggests the auxiliary boiler unit is largely responsible for the spatial distribution of model receptors that exceed the 1-hr NO_2 SIL of 7.5 $\mu g/m^3$.

Table 4. Invenergy AEC Modeled 1-Hour NO_2 SIL Source Group Concentrations ($\mu g/m^3$)

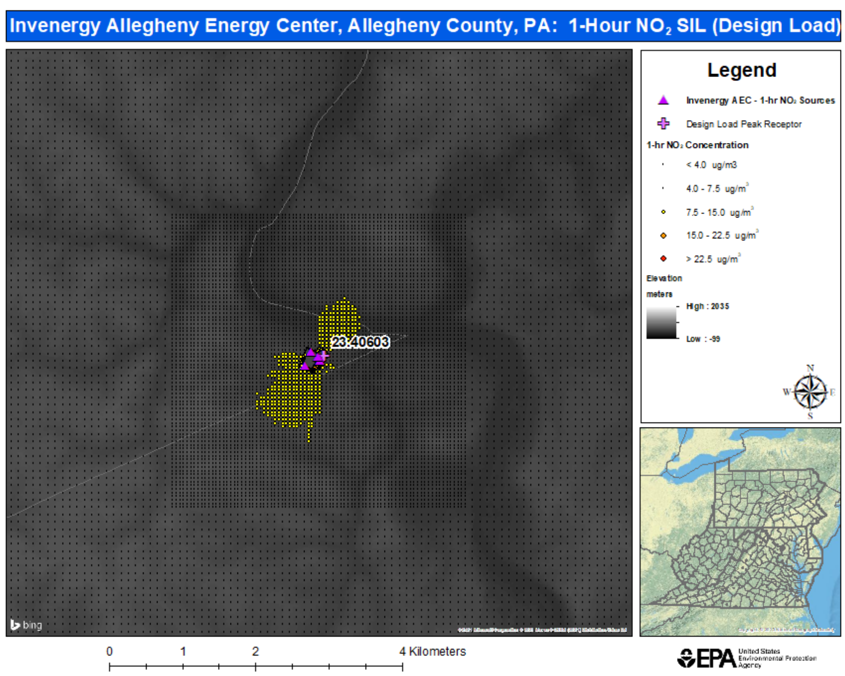
Invenergy Allegheny Energy Center AERMOD 1-Hour NO2 SIL Run

Source Description	Source Max Concentration (ug/m3)
Dew Point Heater	1.15432
Combustion Turbine (Normal Operation)	2.75340
Auxiliary Boiler	23.35562
Invenergy AEC Design Load	23.40603
Combustion Turbine (Cold Start)	28.90934
Invenergy AEC Cold Start	28.94776

Worst-case (combustion turbine cold start) 1-hr NO_2 SIL results shown in Figure 4. While having concentrations near the model peak values of the design load SIL simulation, the figure shows a much wider distribution of model receptors above the SIL. AEC's significant impact area is much larger for the worst-case (cold start) run than the design value run. The peak model concentration is also displaced well away from the AEC. The model peak receptor is approximately 8 km SSW of the combustion turbine stack in somewhat elevated terrain compared to the design load's peak, which occurs right along AEC's plant boundary.

The cumulative 1-hr NO_2 analysis[9] contained 1 model receptor that violated the 1-hr NO_2 NAAQS. This single model receptor is located approximately 9.5 km northwest of the AEC (see Figure 5). AERMOD's MAXDCON option was utilized to determine source contributions to the 1 model receptor violation. Table 5 shows the source (group) contribution to the 1 violating receptor. MAXDCON summarizes source contributions to the violating receptor for each instance when the receptor concentration exceeds 188 $\mu g/m^3$. This includes every instance the receptor exceeds the NAAQS beyond the high-8th high rank. In AEC's cumulative 1-hr NO_2 simulation, the violating receptor had concentrations in excess of the NAAQS through the 13th rank. MAXDCON results indicate AEC's contribution is well under the 1-hr NO_2 SIL at the violating receptor for all instances the receptor exceeds the NAAQS. Given this information, the permit can move forward without any modifications.

Figure 3. Invenergy AEC Design Load 1-Hour NO_2 SIL Model Results



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9 EPA's analysis included output from the modeling archive file "Invenergy ACHD Modeling Review.zip" provided by ACHD, within the subdirectory "Invenergy ACHD Modeling Review/ NOx ACHD V5".

Figure 4. Invenergy AEC Worst Case 1-Hour NO_2 SIL Model Results

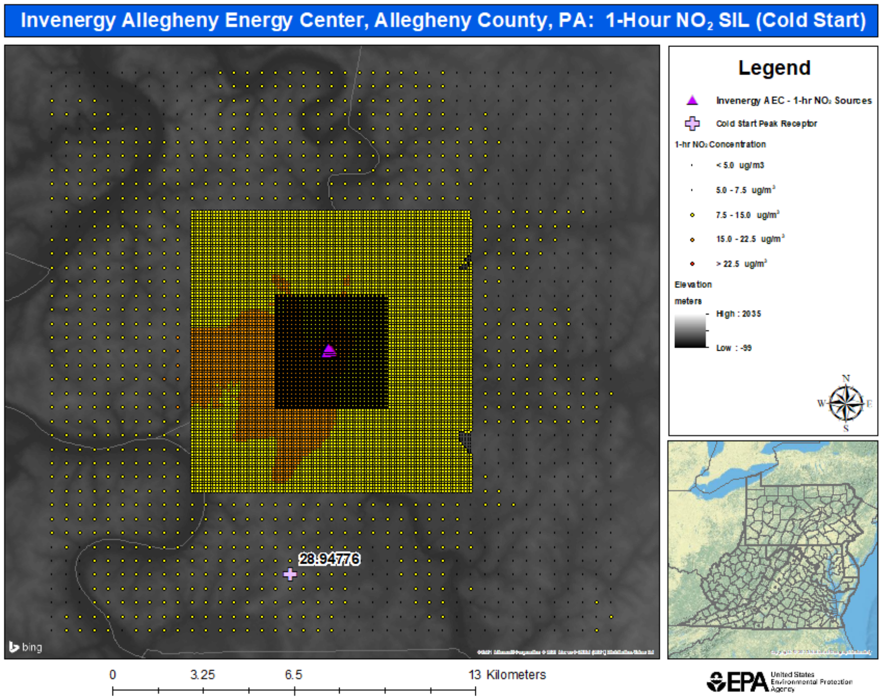

Figure 5. Invenergy AEC 1-Hour NO_2 Cumulative Modeling Results

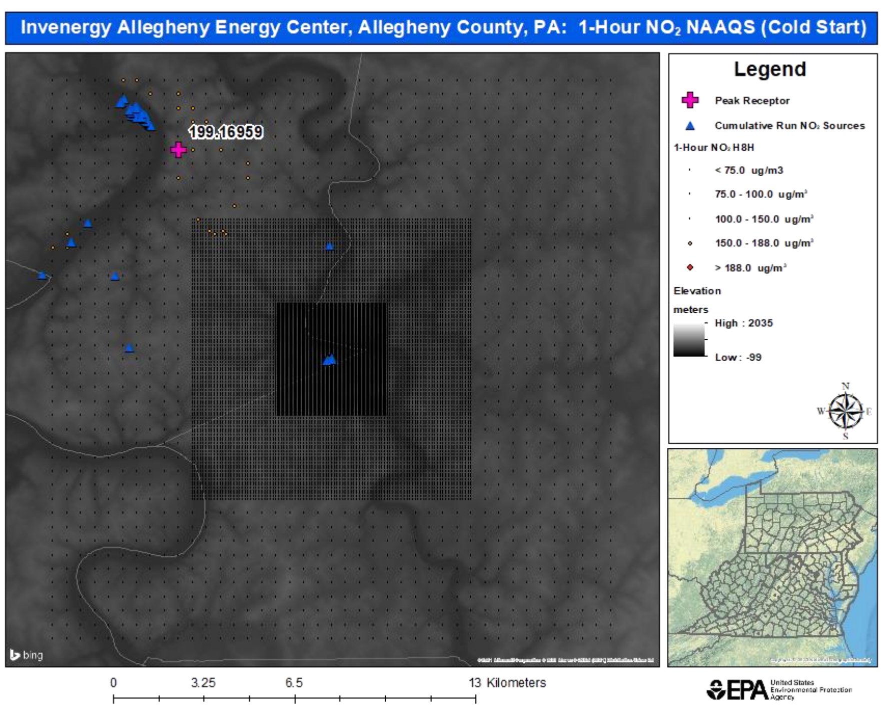

Table 5. Invenergy AEC MAXDCON 1-hr NO_2 Violation Summary

MAXDCON Design Load Output: Source-Group Contribution to Violating Receptor (ug/m3)

Concentration (ug/m3)	Rank	Total Group Contribution (ug/m3)	Clairton Contribution (ug/m3)	Irvin Contribution (ug/m3)	AEC Design Load Contribution (ug/m3)	Background Contribution (ug/m3)
199.1692	8TH	199.1692	147.9231	2.88726	0.00087	48.35495
197.7593	9TH	197.7593	142.0726	2.96700	0.00038	52.71668
194.5032	10TH	194.5032	140.3181	5.14962	0.00086	49.03177
192.7498	11TH	192.7498	142.1218	3.17267	0.00043	47.45253
191.4340	12TH	191.4340	142.5097	0.79102	0.00026	48.12935
189.7688	13TH	189.7688	136.9271	1.17335	0.00029	51.66385

While Invenergy AEC's permit application can move forward, ACHD is still responsible for addressing this modeled violation. The 1-hr NO_2 cumulative modeling results suggest that the Clairton source group is the primary contributor to the model violation with the next largest contribution from the background (monitor) concentration. Clairton also appears to be the closest modeled source group to the violating model receptor.

EPA Comment 06: EPA Region 3 strongly recommends that Allegheny County address any modeled 1-hr NO_2 violation noted in its cumulative modeling analysis. We suggest consideration be given to the following model refinements that may reduce or eliminate the modeled violation.

Model Refinement 1: Use more recently available 1-hr NO_2 background concentrations

EPA processed 1-hr NO_2 monitor concentrations from the Houston and Charleroi monitors in Washington County, PA. We believe the cumulative modeling analysis used the Houston monitor for the modeled background concentration. Table 6 lists the 98^{th}% 1-hr monitor concentrations by season and hour of day. In most instances, monitored 1-hr NO_2 concentrations have declined over the last few years. Remodeling using more recent monitoring data may help alleviate or possibly eliminate modeled NAAQS violations at the violating model receptor.

Table 6. Houston, PA Monitor 98th% 1-hr NO_2 Monitor Concentrations (in ppb)

	Houston 2013-15				Houston 2017-19			
Hour	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall
1	20	11	7	8	16	15	3	10
2	19	9	6	11	14	8	3	9
3	18	10	5	10	16	9	3	9
4	18	11	5	9	18	10	3	9
5	19	12	5	11	18	11	4	10
6	18	14	5	13	16	12	4	11
7	20	11	6	10	16	11	4	12
8	19	13	11	13	17	12	5	11
9	18	19	13	15	17	15	8	10
10	20	22	11	15	17	16	9	11
11	21	16	10	13	16	12	4	12
12	22	13	7	12	18	10	5	10
13	20	12	7	11	20	13	4	10
14	18	13	7	11	17	9	2	9
15	16	11	5	10	17	8	2	13
16	19	11	5	13	17	16	2	14
17	19	10	6	12	19	8	2	14
18	19	12	6	13	21	10	2	15
19	21	13	6	15	18	17	2	15
20	21	13	6	9	16	9	4	15
21	21	15	6	9	15	10	3	10
22	21	11	7	12	16	8	3	10
23	21	11	9	9	15	9	3	11
24	21	10	7	9	15	8	3	10

Model Refinement 2: Reprocess the Meteorological Data to Utilize the Adjust u* Option in AERMET

Table 7 displays the corresponding wind information and other meteorological inputs from the AERMET .sfc file for the H8H modeled 1-hr NO_2 concentration for each year of the AERMOD simulation. As noted earlier, the AERMET file used in the modeling analysis did not utilize the adjusted u* option for period of low winds. Several of the periods that contributed to the violating model receptor occurred during overnight hours with relatively low wind speeds and low u* values.

EPA added the ADJ_U* option within AERMET to address concerns regarding model performance under low wind conditions. The ADJ_U* option in AERMET adjusts the surface friction velocity (u*) under low wind/stable conditions and may be used as a regulatory option in AERMET with NWS data or with site-specific data that does not include turbulence (i.e., sigmaw and/or sigma-theta). Utilizing the AERMET processing option may help alleviate possible model overpredictions under low wind conditions. These conditions appear to occur during some of the hours contributing to the violating model receptor.

Table 7. Select AERMET Values for High 8th-High 1-hr NO_2 Modeled Concentrations

Invenergy Allegheny Energy Center AERMOD 1-Hour NO2 Violation Details

Date	Hour	Design Load (ug/m3)	Cold Start (ug/m3)	Wind Direction	Wind Speed (m/s)	u*	Temperature (C)	Precipitation (mm)	RH (%)	Pressure (mb)	Clouds (10ths)
2010-01-29	18	240.1882	240.1883	311	1.7	0.091	263.2	0	52	985	9
2011-12-07	19	197.8054	197.8055	309	2.0	0.108	274.6	0	88	971	10
2012-02-05	20	190.5851	190.5853	311	2.0	0.113	277.4	0	60	981	3
2013-05-24	23	182.2570	182.2573	310	1.9	0.122	278.4	0	67	984	5
2014-05-24	24	185.0104	185.0115	317	0.8	0.052	288.6	0	71	980	0

Model Refinement 3: Refine Modeled Hourly NO_2 Emissions from Clairton Source Group

The MAXDCON file output suggests the Clairton source group has the largest impact on the violating model receptor in the 1-hr NO_2 cumulative analysis. Table 8 lists the 10 largest NO_2 emission sources in the cumulative modeling analysis. The largest source is Cheswick[10], which is well to the north of Invenergy AEC's significant impact area. The next largest source (CS) is Invenergy AEC's worst-case/cold start operating scenario. The remaining large NO_2 sources appear to be at the Clairton Coke Works. Most of these source emissions appear to be from the plant boilers or coke oven under-firing units.

We believe ACHD provided the most up to date emissions at the time of application preparation. It might be helpful to update these emissions if there are known reductions in the emissions from some of these sources that may help alleviate the modeled 1-hr NO_2 violations. EPA's Guideline on Air Quality Models or Appendix W, was revised. Section 8.2.2 c of Appendix W states, "*[A]s part of a cumulative impact analysis, Table 8–2 allows for the model user to account for <u>actual operations</u> in developing the emissions inputs for dispersion modeling of nearby sources…*". Clairton and other cumulative sources included in the 1-hr NO_2 modeling could therefore use emission rates reflective of actual operations. Additionally, a brief discussion on the proposed closure of some of Clairton's older coke oven batteries[11] and their impacts on future NO_2 emissions could also be included.

[10] Cheswick's 2020 average hourly NO_2 emission rate based on CAMD records appears to be about 30% lower than the modeled emission rate. In 2020, Cheswick operated for only 2,113 hours.
[11] See: https://www.publicsource.org/mon-valley-clairton-us-steel-coke-works-pollution-f-grade-air-quality/

Table 8. Ten Largest NO_2 Emission Sources in the Cumulative Modeling Analysis

Invenergy Allegheny Energy Center Top 10 NO2 Source AERMOD Stack Parameters

Modeled Stack	Type	Group	Emission Rate (g/s)	Emission Rate (lbs/hr)
CHESWICK	POINT	Cheswick	94.7645	752.11
CS	POINT	AES Worst Case	31.8239	252.57
CLCOMB20	POINT	Clairton	15.7134	124.71
CLBLR1	POINT	Clairton	13.0972	103.95
CLCOMBB	POINT	Clairton	10.6956	84.89
CLCOMB19	POINT	Clairton	9.7594	77.46
CLCOMB3	POINT	Clairton	5.7136	45.35
CLCOMB1	POINT	Clairton	5.5270	43.87
CLCOMB2	POINT	Clairton	5.2098	41.35
CLBLR2	POINT	Clairton	4.9168	39.02

Model Refinement 4: If model 1-hr NO_2 violations persist, Allegheny County should consider utilizing a Tier 3 NO_2 option within AERMOD.

EPA Comment 07: Allegheny County should consider updating its Modeled Emission Rates for Precursors (MERPs) analysis for the Invenergy AEC to account for EPA's updated guidance[12]. EPA does not anticipate the overall outcome of the MERPs analysis to change but using more updated guidance could demonstrate the plant's impact on secondary formation of O_3 or ozone and PM-2.5 is somewhat improved. ACHD's analysis of the plant's impact on ozone values could be less significant using more recent (lower) design values, given these design values are not spuriously impacted by unusual weather conditions and/or mobile source emission changes due to COVID.

EPA Comment 08: Allegheny County should consider the following points that would bolster its conclusion that the Invenergy AEC should not hamper the county's ability to meet and maintain the 2012 PM-2.5 NAAQS. These could be considered as ancillary supporting evidence in addition to Allegheny County's MERPs analysis for secondary PM-2.5 formation.

[12] See: https://www.epa.gov/sites/production/files/2020-09/documents/draft_guidance_for_o3_pm25_permit_modeling.pdf

- PM-2.5 impacts from NOx emissions, which form nitrates, are generally less important in Allegheny County than other PM-2.5 components. PM-2.5 speciation monitoring results reported by Allegheny County[13] indicate recent nitrate levels are generally lower than sulfate, organic carbon and elemental carbon components at its Liberty monitor. This monitor typically has the highest PM-2.5 design values in the county. We also note that nitrate levels are seasonal with higher concentrations occuring in the colder winter months. Seasonal contributions to local PM-2.5 levels would therefore be expected from AEC's NOx emissions.
    - Allegheny County's recent PM-2.5 SIP revision includes speciation breakdowns of the Liberty monitor's urban excess. This analysis can be found in Appendix C[14] of the county's most recent PM-2.5 SIP revision. Results from this analysis indicate nitrate levels in southern Allegheny County (near the Invenergy AEC project) are lesser contributors to local PM-2.5 concentrations. Allegheny County's analysis identifies sulfates, organic carbon and elemental carbon as more important PM-2.5 speciation components near the Liberty monitor than nitrates.
- Allegheny County has frequently described the impact of vertical atmospheric temperature inversions on local air quality in the Mon-Valley[15]. Generally speaking, Allegheny County has described how these inversions "trap" emissions in Allegheny County's river valleys contributing to elevated local pollution levels, mainly PM-2.5 and other particulate. It appears that the Invenergy AEC main combustion-turbine stack may be high enough to loft emissions such that they would not be overly impacted by local vertical temperature inversions. If Allegheny County can supply this supporting evidence, AEC's emissions may not contribute to local PM-2.5 concentrations that are subject to these atmospheric phenomena.
- Allegheny County's recent PM-2.5 SIP demonstration[16] indicates the county will meet the NAAQS by its proposed attainment date (2021). Allegheny County may want to review its PM-2.5 SIP to determine if sources similar to Invenergy AEC were added to its projected (future) year emission inventory. Inclusion of an electric generating source(s) in the county or region that are similar or larger than Invenergy AEC would bolster the

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[13] See PM-2.5 Speciation section of Allegheny County 2019 Air Monitoring Report: https://www.alleghenycounty.us/uploadedFiles/Allegheny_Home/Health_Department/Resources/Data_and_Reporting/Air_Quality_Reports/2019-Air-Quality-Annual-Report.pdf

[14] See Speciation Excess section of Appendix C to the *Attainment Demonstration for the Allegheny County, PA $PM_{2.5}$ Nonattainment Area, 2012 NAAQS* (*https://www.alleghenycounty.us/Health-Department/Programs/Air-Quality/Regulations-and-SIPs.aspx*)

[15] See: The Art and Science of Forecasting Morning Temperature Inversions https://www.alleghenycounty.us/uploadedFiles/Allegheny_Home/Health_Department/Programs/Air_Quality/Sadar-EMPlus-article-reprint.pdf

[16] Attainment Demonstration for the Allegheny County, PA PM2.5 Nonattainment Area, 2012 NAAQS, September 2019. See: https://www.alleghenycounty.us/uploadedFiles/Allegheny_Home/Health_Department/Programs/Air_Quality/SIPs/90-SIP-PM25-ATTAIN-2012-NAAQS-09-12-2019.pdf

conclusion that the addition of this new power plant will not hamper future attainment of the PM-2.5 NAAQS since the PM-2.5 modeling demonstration showed compliance with new sources similar to Invenergy AEC in the area.

- Invenergy AEC will be required to secure NOx emission off-sets before plant operations can begin since it is subject to Ozone Transport Region or OTR offset requirements. If emission reduction credits (ERCs) are secured from sources within Allegheny County (or very close to it), one could argue that these ERCs would help mitigate AEC's future emission impacts on local PM-2.5 (and O_3) concentrations in the county.